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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/578,835 | 05/10/2006 | Toshio Goto | Q78632 | 3740 |

23373 7590 06/07/2010

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| EXAMINER | |
|---|---|
| MCDONALD, RODNEY GLENN | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1795 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 06/07/2010 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/578,835 | GOTO ET AL. | |
| | Examiner | Art Unit | |
| | Rodney G. McDonald | 1795 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *19 February 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-3 and 5-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-3 and 8* is/are allowed.

6)☒ Claim(s) *5-7 and 9-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 5, 6 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mori et al. (U.S. Pat. 6,136,214) in view of Tanaka et al. (U.S. Pat. 6,590,179).

Regarding claims 5, 6, Mori et al. teach a method of generating radicals. (Column 3 lines 3-14) Mori et al. teach feeding $F_2$ gas or a mixed gas of $F_2$ gas and an inert gas into a chamber of which the inside is provided with a carbon material. (Column 3 lines 3-14; Column 8 lines 54-63) Mori et al. teach supplying a carbon atom from the carbon material by applying a target bias voltage to the carbon material. (Column 3 lines 3-14) Mori et al. generate high density radicals. (Column 7 lines 23-

27) The bias voltage is not more than 600 V applied to the carbon material to selectively form $CF_3$ radical and thereby high purity $CF_3$ radical is generated. (Column 6 lines 66-7; Column 7 lines 1-7) Mori et al. teach the carbon atom is generated by magnetron sputtering of the carbon material. (Column 6 lines 18-19; Column 5 lines 31-33) Mori et al. teach a method for etching a silicon oxide film comprising etching a silicon oxide film using high purity $Cl_3$ radical generated by the method for generating radicals. (Column 3 lines 3-14) Mori et al. teach controlling voltage. Exemplified is controlling the voltage up to -150 V but one of ordinary skill could go beyond since Mori et al. recognize that this controls the relative densities of the radicals in the plasma. This optimizes for best results. (See Fig. 3; Column 6 lines 66-67; Column 7 lines 1-7)

Regarding claim 9, Mori et al. teach etching a film consisting essentially of a silicon oxide film and a resist using radicals containing CF3 and CF2 radicals generated by the method for generating radicals. The ratio of the density if the CF3 radical to the density of CF2 radical can be controlled to be not more than 10. (Column 13 lines 52-56; Fig. 3)

The differences between Mori et al. and the present claims is that controlling the ratio of radicals by controlling the target bias voltage applied to the carbon material while measuring the infrared absorption spectrum of radicals generated inside the chamber is not discussed (Claim 5).

Regarding controlling the ratio of radicals by controlling the target bias voltage applied to the carbon material while measuring the infrared absorption spectrum of radicals generated inside the chamber (Claim 5), Mori et al. already teach utilizing an

optical emission spectrometer and feedback circuit to control the voltage to control the density of radicals produced. (Column 6 lines 41-68; Column 7 lines 1-7) Tanaka et al. teach measuring the infrared absorption spectrum in the chamber for control. (See Tanaka et al. Column 5 lines 26-39)

The motivation for utilizing the features of Tanaka et al. is that it allows for providing means for monitoring a plasma apparatus. (See Tanaka et al. Column 2 line 44)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Mori et al. by utilizing the features of Tanaka et al. because it allows for providing means for monitoring the plasma.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mori et al. in view of Tanaka et al. as applied to claims 5, 6 and 9 above, and further in view of Ohmi (U.S. Pat. 5,272,417) or Celestino et al. (U.S. Pat. 4,579,618) or Gorin (U.S. Pat. 4,464,223).

Mori et al. is discussed above and all is as applies above. (See Mori et al. discussed above)

The differences between Mori et al. and the present claims is that utilizing a dual frequency applied to the target electrode using a high frequency power source and a low frequency power source is not discussed (Claim 7).

.Regarding claim 7, Ohmi teach applying multiple frequencies to an electrode to control the energy of the ions. (Column 12 lines 36-68; Column 13 lines 1-2)

The motivation for utilizing the features of Ohmi is that it allows to control the energy of the ions. (Column 12 line 38)

Regarding claim 7, Celestino et al. teach applying two frequencies to an electrode using a high frequency power source and a low frequency power source. (See Abstract; Column 3 lines 21-52)

The motivation for utilizing the features of Celestino et al. is that it allows for increasing the control of the plasma ion energy. (Column 4 lines 63-68)

Regarding claim 7, Gorin teach applying two frequencies to an electrode using a high frequency power source and a low frequency power source. (Column 2 lines 58-68; Column 3 lines 1-63; Column 4 lines 3-14)

The motivation for utilizing the features of Gorin is that it allows for controlling ion energy. (Column 1 lines 39-40)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Mori et al. by utilizing the features of Ohmi or Celestino et al. or Gorin because it allows for controlling ion energy.

Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mori et al. (U.S. Pat. 6,136,214) in view of Ohmi (U.S. Pat. 5,272,417) or Celestino et al. (U.S. Pat. 4,579,618) or Gorin (U.S. Pat. 4,464,223) and Tanaka et al. (U.S. Pat. 6,590,179).

Mori et al. is discussed above and all is as applies above. (See Mori et al. discussed above)

The differences between Mori et al. and the present claims are that utilizing a dual frequency applied to the target electrode using a high frequency power source and a low frequency power source is not discussed (Claims 10, 11) and the chamber being connected with an infrared absorption spectrometer so that IR laser irradiated from the infrared absorption spectrometer passes through between the application electrode and counter electrode is not discussed (Claims 10, 11).

.Regarding utilizing a dual frequency applied to the target electrode using a high frequency power source and a low frequency power source (Claims 10, 11), Ohmi teach applying multiple frequencies to an electrode to control the energy of the ions. (Column 12 lines 36-68; Column 13 lines 1-2)

The motivation for utilizing the features of Ohmi is that it allows to control the energy of the ions. (Column 12 line 38)

Regarding utilizing a dual frequency applied to the target electrode using a high frequency power source and a low frequency power source (Claims 10, 11), Celestino et al. teach applying two frequencies to an electrode using a high frequency power source and a low frequency power source. (See Abstract; Column 3 lines 21-52)

The motivation for utilizing the features of Celestino et al. is that it allows for increasing the control of the plasma ion energy. (Column 4 lines 63-68)

Regarding utilizing a dual frequency applied to the target electrode using a high frequency power source and a low frequency power source (Claims 10, 11), Gorin teach applying two frequencies to an electrode using a high frequency power source and a

low frequency power source. (Column 2 lines 58-68; Column 3 lines 1-63; Column 4 lines 3-14)

The motivation for utilizing the features of Gorin is that it allows for controlling ion energy. (Column 1 lines 39-40)

Regarding the chamber being connected with an infrared absorption spectrometer so that IR laser irradiated from the infrared absorption spectrometer passes through between the application electrode and counter electrode (Claims 10,11), Tanaka et al. teach measuring the infrared absorption spectrum in the chamber for control. An IR laser can be utilized. In Fig. 1 it would pass between the two electrodes. (See Tanaka et al. Column 5 lines 26-39; Fig. 1)

The motivation for utilizing the features of Tanaka et al. is that it allows for providing means for monitoring a plasma apparatus. (See Tanaka et al. Column 2 line 44)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Mori et al. by utilizing the features of Ohmi or Celestino et al. or Gorin and to have utilized the features of Tanaka et al. because it allows for controlling ion energy and for monitoring the plasma.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mori et al. (U.S. Pat. 6,136,214).

Mori et al. is discussed above and all is as applies above. (See Mori et al. discussed above) Mori et al. teach controlling voltage. Exemplified is controlling the voltage up to -150 V but one of ordinary skill could go beyond since Mori et al.

recognize that this controls the relative densities of the radicals in the plasma. This optimizes for best results. (See Fig. 3; Column 6 lines 66-67; Column 7 lines 1-7)

The difference between Mori et al. and the present claims is that the F2 gas concentration in the mixed gas being from 0.1 to 4.0% by volume is not discussed. (Claim 12)

Regarding claim 12, in some examples Mori et al. teach the total gas flow to be 20-300 sccm, 50-500 sccm, or 100-500 sccm. SF6 is used as a fluorine gas at a flow rate of 1-10 sccm. SF6 falls within Applicant's range of volume percent. Mori et al. also recognize F2 can be used in place of SF6. Therefore F2 would also fall within Applicant's range of volume percent. (Column 8 lines 1-8; Column 8 lines 54-68; Column 13 lines 38-40; Column 15 lines 8-23)

The motivation for utilizing the features of Mori et al. is that it allows for generating an exact amount of reactive species required for etching. (Column 2 lines 66-67)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Mori et al. because it allows for generating an exact amount of reactive species required for etching.

***Allowable Subject Matter***

Claims 1, 2, 3 and 8 are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

Claims 1, 2, 3 and 8 are allowable over the prior art of record because the prior art of record does not teach generating radicals, wherein the bias voltage of 480 to 600 V is applied to the carbon material to selectively form $CF_3$ radical and thereby $CF_3$ radical is generated.

The closest prior art of record to Mori et al. (U.S. Pat. 6,136,214) while teaching generating radicals by applying a bias voltage to carbon material to form $CF_3$ radicals and producing a ratio of different radicals in the chamber fails to teach generating radicals, wherein the bias voltage of ***480 to 600 V*** is applied to the carbon material to ***selectively form $CF_3$ radicals***. In fact it appears that Mori et al. teach away from the present invention because at higher voltages the amount of $CF_3$ radicals decrease and thus Mori et al. do not controlling the voltage to selectively form the $CF_3$ radicals.

***Response to Arguments***

Applicant's arguments filed February 19, 2010 have been fully considered but they are not persuasive.

***The 35 U.S.C. 112, Second Paragraph Rejections:***

The 35 U.S.C. 112, Second Paragraph Rejections have been withdrawn based on Applicant's Amendment.

***The 35 U.S.C. 102 Rejection:***

The 35 U.S.C. 102 Rejection has been withdrawn based on Applicant's Amendment and Arguments.

***The 35 U.S.C. 103 Rejection of Claims 3 and 4:***

The 35 U.S.C. 103 Rejection of Claims 3 and 4 has been withdrawn based on Applicant's Amendment and Arguments.

***The 35 U.S.C. 103 Rejection of Claims 5, 6 and 9:***

In response to the argument that there is no disclosure or suggestion in the cited documents about the specific radical generating method of the present invention, namely the radical generating method by which the ratio of CF3 radicals, CF2 radicals and CF radicals is arbitrarily regulated by controlling the target bias voltage of not less than 700 V applied to the carbon material while measuring the infrared absorption spectrum of radicals generated inside the chamber, it is argued that Mori et al. teach controlling voltage. Exemplified is controlling the voltage up to -150 V but one of ordinary skill could go beyond since Mori et al. recognize that this controls the relative densities of the radicals in the plasma. This optimizes for best results and would allow for controlling the ratio of the radicals. (See Mori et al. Fig. 3; Column 6 lines 66-67; Column 7 lines 1-7) Tanaka et al. teach measuring the infrared absorption spectrum in the chamber for control. (See Tanaka et al. Column 5 lines 26-39)

***The 35 U.S.C. 103 Rejection of Claim 7:***

In response to the argument that Ohmi, Celestino et al., and Gorin do not make up for the deficiencies of Mori and Tanaka and thus claim 7 which depends from claim 5 is not obvious over the cited art, it is argued that Mori and Tanaka teach the requirements for claim 5 and thus Claim 7 is not allowable for the same reasons.

***The 35 U.S.C. 103 Rejection of Claims 10 and 11:***

In response to the argument that the cited documents have no disclosure or suggestion about the specific radical generating apparatus or the specific etching apparatus and the obtainable excellent effects of the claimed invention, the skilled person would have no motivation to achieve the apparatuses of the present invention, it is argued that Mori et al. teach the specific radical generating apparatus and etching apparatus as discussed above to achieve the radical control and etching effects as required by claims 10 and 11. (See Mori et al. discussed above)

In response to the argument that Tanaka do not teach a specific teaching with respect to the electrodes or how the laser would pass between the two electrodes, it is argued that Tanaka teach passing a laser between two electrodes in order to measure the infrared absorption spectrum for process control. (See Tanaka et al. discussed above)

***The 35 U.S.C. 103 Rejection of Claims 12:***

In response to the argument that the prior art does not teach utilizing a target bias voltage of not less than 480 V, it is argued that Mori et al. teach controlling voltage. Exemplified is controlling the voltage up to -150 V but one of ordinary skill could go beyond since Mori et al. recognize that this controls the relative densities of the radicals in the plasma. This optimizes for best results and would allow for controlling the ratio of the radicals. (See Mori et al. Fig. 3; Column 6 lines 66-67; Column 7 lines 1-7)

## *Conclusion*

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M-Th with every Friday off..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rodney G. McDonald/
Primary Examiner, Art Unit 1795

Rodney G. McDonald
Primary Examiner
Art Unit 1795

RM
June 2, 2010